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It will be seen that the characters of the two organisms are almost identical, except that the number of cilia according to Harrison is 7 to 13, while Potter states that there is a single polar cilium. Agar cultures of *Pseudomonas destructans*, Potter, were stained by Ellis's method,[1] and a single polar cilium was observed. On the other hand, photographs of *Bacillus oleraceæ*, Harrison, show a number of cilia. But as the presence of cilia in bacteria is somewhat variable, according to the age of the culture, nature of culture material, &c., there is a very strong presumption in favour of the two organisms being identical.

It may also be mentioned that a brownish rot, similar to that of cabbage, has occurred in celery from Counties Derry and Tyrone, and is caused by a motile bacterium occurring singly or in rod-like colonies, and measuring $1{\cdot}4\mu \times {\cdot}7\mu$.

The various county records given for the organisms described in the preceding pages are based mainly on diseased specimens sent by the Instructors employed by the Department of Agriculture in these counties.

[1] Ellis, D., "On the Discovery of Cilia in the genus Bacterium" (Centralb. f. Bakt., Abteil. ii., Band ii., 1904).

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* LONDON *

II.

INJURIOUS INSECTS AND OTHER ANIMALS OBSERVED IN IRELAND DURING THE YEAR 1909.

By GEORGE H. CARPENTER, B.SC., LOND., M.R.I.A., Professor of Zoology in the Royal College of Science for Ireland; President-elect of the Association of Economic Biologists; and Consulting Entomologist to the Royal Dublin Society.

(Plate II.)

[Read April 26; Ordered for Publication May 10; Published July 6, 1910.]

CORN INSECTS.

Wireworms.

Agriotes lineatus (Linn.) and *A. obscurus* (Linn.).

Great complaints were made by farmers in Cos. Dublin and Wicklow of severe damage to the oat-crop by wireworms in the late spring of 1909. Extensive bare patches were to be seen during May in many fields; and in some places the crop had to be partly re-sown. A continuance of dry weather during the sprouting season was favourable to the activity of the click-beetle grubs, whose power for mischief became, however, much reduced by subsequent heavy rains.

The Frit Fly.

Oscinis frit (Linn.).

A number of these small black flies were received early in October from Queen's County, where they had been found on newly threshed wheat. The insect has already been described and figured in this series of papers (3, pp. 147–8).

CABBAGE AND TURNIP INSECTS.

The Red-headed Flea Beetle.

Psylliodes chrysocephala (Linn.).

The stem-burrowing habits of the larva of this beetle have been previously described (3, pp. 427–30). In June, cabbage plants

with the central stem bored in the characteristic manner were received from Dundalk. Evidently this species is becoming of increasing importance as an enemy of cruciferous crops.

The Root Gall-Weevil.

Ceuthorrhynchus pleurostigma, Marsh.

Turnips covered with the rounded galls caused by the grub of this beetle were received from Dundalk in Christmas week. The insect has been lately described and figured (3, pp. 425–7).

The Cabbage Fly.

Phorbia brassicæ, Bouché.

Every year many complaints are heard as to ravages by the maggots of this common fly; and during 1909 the damage was very serious and widespread. In localities from Cos. Galway and Tyrone to Cos. Antrim and Dublin the maggots were noticed both in cabbages and turnips. Most of the specimens were received during September. In a consignment from Lisburn the maggots had attacked small swedes in a peculiar manner, burrowing, not, as is usual, in the roots, but in the leaf-stalks, where a bad "rot" was descending into the root-tissue. In a Co. Dublin garden a single cauliflower root contained twenty-four grubs. My friend Dr. G. H. Pethybridge observed serious damage by these maggots to swedes near Clifden, Co. Galway; but he noticed that a plot of white turnips alongside the swedes remained free from attack.

Turnip Eelworms.

Rhabditis brassicæ, Southern.

Reference is necessary to the very interesting description by Southern (11) of minute eelworms found in large numbers in rotting turnips from Co. Westmeath. These belong to the same family (Anguillulidae) as the well-known destructive species *Tylenchus devastratrix*, but to a distinct genus, Rhabditis, whose members have no piercing stylet in the mouth. Specimens of *R. brassicae* measure from 1 to 1·5 mm. ($\frac{1}{25}$ to $\frac{3}{50}$ inch) in length. There are about equal numbers of males and of individuals with

the structure of females, but with a chamber containing sperm-cells in each uterus, so that many of the eggs produced can be self-fertilized as they pass through this chamber before extrusion. This species, according to Southern, "probably represents one of the earliest stages in the transformation from the dicœcious to the hermaphrodite condition."

With regard to the power of these worms to originate disease, Southern writes:—"When placed in contact with a cut surface, they quickly reduced the turnip to a pulp. . . . Attempts to inoculate a turnip through the uninjured epidermis, however, quite failed. . . . The evidence thus goes to show that this species . . . cannot originate disease, but that if they can gain access to the soft tissues, through injury to the epidermis, they will quickly destroy the plants."

MANGEL INSECTS.

The Mangel Fly.

Pegomyia betae (Curtis).

Maggots and puparia of this well-known fly were received in August from King's County. The insect has already been described and figured by me with some detail (3, pp. 289–291, plate xxiii.). The puparia remained in my laboratory through the winter, and several flies emerged from them during March of the present year.

The Beet Carrion-Beetle.

Silpha opaca, Linn.

Larvae of this beetle were sent to me in June from Co. Kildare. A description with figures may be found in a previous paper (3, pp. 431–2).

The Black Aphid.

Aphis rumicis, Linn.

These Aphids—described in my last paper (3, pp. 594–5) as destructive to mangels—were noticed again during 1909 attacking the same crop, in Queen's County towards the end of August and in Co. Waterford during September. The observer in the former county, whose communication came to me through the editor of

the *Farmers' Gazette,* stated that the aphids settled on the underside of the leaves and in the "heart," so that the larger leaves soon began to curl up, and the smaller ones in the "heart" to perish. Along with these aphids were maggots of a hover-fly (Syrphus), which were doubtless feeding on them.

POTATO INSECTS, &c.

The Frosted Orange Moth.

Gortyna ochracea, Hübn.

The stem-boring habit in potato plants of the caterpillars of this moth seems to become each season more prevalent. During the latter half of June, specimens were received from Co. Tyrone, Queen's Co., and Co. Mayo. The insect was described and figured by me several years ago (3, pp. 253–4).

Spotted Millipedes.

Blaniulus sp.

Late in September, Dr. Pethybridge sent me millipedes of this genus taken from potato-tubers in Co. Mayo. He stated that the pests were especially numerous in cases where the tubers were suffering from fungoid disease (Spongospora). In connexion with this observation, attention may be drawn to the opinion, recently expressed by Theobald (13, p. 99), that millipedes are never directly injurious to plants, attacking only decaying or unhealthy vegetation. Dr. Pethybridge's observations, which he has kindly communicated to me, show that a very small external injury to the skin of a potato is sufficient to afford the millipedes a means of entrance to the tuber, and this once gained, they undoubtedly cause very great injury. He placed some millipedes on a potato affected with Spongospora in a damp atmosphere, and noticed that they quickly found out a couple of wounds in the skin and began to feed there. Their yellowish excrement, which became plentiful in a few days, consisted of elongate masses, made up almost entirely of unaltered starch-grains. Subsequently Dr. Pethybridge placed a dozen of the millipedes in a dish containing three tubers with perfectly sound skins resting on moist silver sand. The tubers had on them a few small spots of the

fungus Corticium. After ten days he found that the millipedes had not eaten their way into the tubers and had become sluggish, while their excrement was now black and consisted entirely of undigested remains of the cell-walls of Corticium-hyphæ.

TOBACCO INSECTS.

The Cabbage Moth.

Mamestra brassicae (Linn.).

In a previous paper (3, pp. 573–4) reference was made to the tobacco-eating habit of the caterpillars of this moth, and of its ally *M. oleracea* (Linn.). In the middle of August specimens of the Cabbage moth caterpillar were received from tobacco plots in Co. Wexford.

ORCHARD INSECTS.

The Apple Aphid.

Aphis pomi, De Geer.

Twigs of apple-trees with the black eggs of this insect in numbers on the bark were received from Co. Tyrone in February, and in August shoots infested with multitudes of the winged sects came from Portadown. It has been shown by Sanderson (9) in the United States, and by Theobald (12, pp. 133–140) in Great Britain, that in addition to the well-known Woolly Aphid ("American blight"), three distinct species of aphid may occur on the apple; *Aphis pomi*, De Geer, *A. sorbi*, Kalt., and *A. Fitchii*, Sanderson. We certainly have both the first and second of these in Ireland, but the first appears to be by far the more common and harmful. *A. sorbi* and *A. Fitchii* migrate in summer from the apple-trees to other plants—probably grasses—but *A. pomi* remains in the orchards throughout the year. Hence it is called the Permanent Apple Aphid.

Aphis pomi has the life-cycle usual among aphids in these countries. From the hard-shelled, black winter-eggs are hatched in April the young insects which grow into the "stem-mothers," wingless females that have the power of virgin reproduction, so that, their eggs developing unfertilized within their bodies, they give birth to numerous active young which grow rapidly into wingless females capable of the same kind of reproduction; and

this process goes on through successive generations. These wingless females are green, with yellow head, legs and feelers, the knees, the tips of the shins, and the feet being black, as well as the rows of tubercles on the sides of the abdomen, the tail-process, and the elongate paired cornicles on the abdomen (fig. 1, *c*). Owing to the rapid rate of development, the number of aphids increases enormously, and, since they cause the leaves to curl and wrinkle, they are provided with shelter as they suck sap from the soft green tissue.

Fig. 1.—Apple Aphid (*Aphis pomi*): (*a*) winged virgin female; (*b*) nymph with wing-rudiments; (*c*) wingless virgin female; (*d*) new-born young. Magnified 12 times. From Quaintance, Entom. Circ. 81, U. S. Dept. Agric.

As the summer progresses young forms are born which grow into nymphs (fig. 1 *b*) with wing-rudiments, ultimately becoming winged virgin females (fig. 1 *a*). These, having the power of flight, are able to migrate to other trees. They have the head brown, the thorax blackish, and the abdomen green with lateral black spots; the legs are yellowish-white with black knees, shin-tips, and feet. After a large series of generations of virgin females—some winged, others wingless—the males (fig. 2 *a*) and egg-laying females (fig. 2 *b*) are developed in autumn; among the apple-haunting aphids these sexual insects are wingless and

much smaller than the virgin females. The male is brown with blackish head, feelers, legs, tail-process, and cornicles; while the female is green with the legs partly pale and partly black, and the tail-process and cornicles black. After pairing, these females lay the eggs that carry the species over the winter.

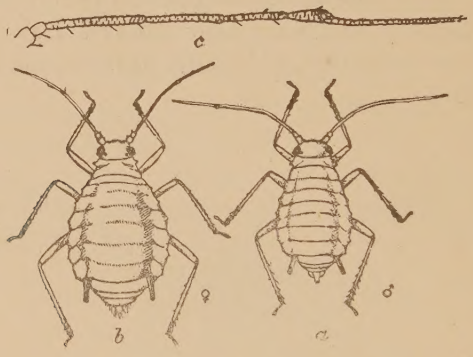

Fig. 2.—Apple Aphid (*A. pomi*): (*a*) Male; (*b*) egg-laying female. Magnified 12 times. (*c*) Feeler of male. Magnified 36 times. From Quaintance, Entom. Circ. 81, U. S. Dept. Agric.

As these eggs are exposed on the twigs, it would manifestly be a great advantage to the fruit-grower could they be killed by winter-spraying. Unfortunately there is no wash which can be relied upon to destroy them. Spraying must therefore be practised against the active insects; and the question as to the time of year when such application would be most effectual is rather important. The leaf-curling habit of this species renders spraying during the summer, when the aphids are most numerous, almost useless. We have therefore to choose between the early spring, when the stem-mothers are being hatched from the eggs, and the autumn, when the males and females are on the trees, but have not yet laid their eggs.

On this important question Theobald (12, p. 140) gives a strong opinion in favour of autumn spraying. The sexual autumnal generation is, he considers, "the most vulnerable stage in the life-history." He writes:—"When we find the small sexual forms under the leaves is the time to kill them. At this time a heavy paraffin-emulsion may be used, as the leaves are of

little value, and it does not matter if we burn them. The emulsion must not be put on with much force, as the leaves may be knocked off. The tree should have a good spraying, and the ground below be well wetted and also the trunk; the oviparous females will then be killed." Theobald points out that the result of spraying at springtime is often disappointing, because the hatching period extends over several weeks, so that when some young aphids have just emerged from the eggs and would be vulnerable to the wash, others have been out for some time, and are already protected under the curled leaves.

Fig. 3.—Currant Aphid (*Rhopalosiphum ribis*): (*a*) Wingless virgin female. (*b*) wings of winged virgin female. Magnified 15 times. After Buckton, British Aphides, vol. ii.

Gooseberry and Currant Aphids.

Rhopalosiphum ribis (Linn.) and *Myzus ribis* (Linn.).

These two species are probably common and injurious every year throughout the country. During 1909 the former species was reported in August from Westport, Co. Mayo, as injurious both to gooseberry and to red currant; while the latter was sent from Co. Meath in May, on very badly shrivelled gooseberry shoots.

In the genus Rhopalosiphum the cornicles are swollen in the middle so as to be spindle-shaped or club-shaped. The wingless virgin female (fig. 3 *a*) is green with red eyes, and about 2·5 mm. ($\frac{1}{10}$ inch) long. The winged female is yellowish-green with black head, feelers, and thorax, and black abdominal spots, knees, and feet. These aphids are found beneath the leaves of the bushes, sheltering in little blisters, which show as reddish swellings on the upper surface of the leaf. It is generally believed that these swellings are caused by the piercing of the leaf-tissue by the aphids; but Theobald (12, pp. 217–8) declares that they begin to be formed before any aphids have hatched from the eggs.

Myzus ribesii causes the leaves to curl and twist, but does not appear to form blisters. The wingless virgin female is green with red eyes like that of *Rhopalosiphum ribis*, but smaller, only 2 mm. ($\frac{1}{12}$ inch) long. The green winged virgin female has olive head, brown thorax, and blackish cornicles.

For destroying these aphids Theobald recommends early spraying with paraffin-emulsion, before the leaves have become blistered or curled. He points out that the wash must be applied so as to reach the under-surface of the leaves.

The Cherry Aphid.

Myzus cerasi (Fab.).

Cherry shoots injured by this well-known aphid were received in August from Co. Carlow. The insects occur in numbers on the shoots, and cause the leaves to curl; while, as they secrete much sticky "honeydew" on which fungi grow, their presence is highly objectionable In bad cases the crop may be destroyed.

The wingless virgin female of this species (fig. 4, *c*) is black, with the legs partly yellowish; the winged virgin female (fig. 4 *b*) is largely black, but with greenish abdomen. Theobald states that these suddenly leave the cherry-trees in July, and migrate to some other host-plant unknown. Apparently they return to the cherry in October, for the small dark brown wingless egg-laying females (fig. 4 a) are then found accompanied by winged males, and their eggs remain on the trees through the winter.

Theobald recommends (12, p. 199) strong autumnal spraying, as for the apple aphids, and states that summer spraying with quassia and soap may be effectual if the insects can be caught on the shoots before they have made their attack on the leaves.

Fig. 4.—Cherry Aphid (*Myzus cerasi*): (*a*) egg-laying female; (*b*) winged virgin female; (*c*) wingless virgin female. Magnified 15 times. After Buckton, British Aphides, vol. i.

The Soft Brown Scale.

Lecanium capreae (Linn.).

In the year 1906 this insect was noticed on apple and peach twigs from Co. Cavan (3, p. 441, pl. xliii. A). In June, 1909, the same scale was sent from Newmarket, Co. Clare, by Mr. P. Quealy, who stated that it had done considerable damage to apple-trees for several years past. In July the insect was sent from Co. Antrim. As the young are hatched in late summer, that would be, as pointed out by Theobald (12, p. 176), the best time for spraying to keep this pest in check.

The March Moth.

Anisopteryx æscularia, Schiff.

(Plate II., A.)

Males of this moth were received in March, sent from Clogher, Co. Tyrone, by Mr. T. S. Porter, who also, in May, forwarded specimens of the eggs taken on apple-trees. This insect, as its name suggests, appears in March, though Theobald states (12, p. 62) that it may be found as early as the middle of February, or as late as the middle of April. The male (Plate II., A) measures from 30 to 37 mm. ($1\frac{1}{4}$–$1\frac{1}{2}$) across the wings, which are greyish-brown, variegated with dark and pale wavy lines. The female, like that of the allied Winter Moth (*Cheimatobia brumata*) — see 3, pp. 329–31, pls. xxvii., xxviii.—is wingless, and incapable of flight; she has a remarkable tuft of hairs at the tail-end of the body. Having climbed up the trunk of the tree, she lays her eggs in rows, forming an incomplete band around a twig; from 50 to 200 or more eggs are laid together; and they are partly covered with hairs derived from the mother's tail-tuft. The caterpillar, about 25 mm. (1 inch) long when fully grown, more slender than that of the winter moth, is green, with white or greyish dorsal and lateral lines. About midsummer these caterpillars are fully fed; then they go down to the ground and pupate beneath the soil, the moths not emerging till March of the ensuing year.

Grease-bands on the trunks, as recommended for the Winter Moth, if kept in order till the spring, will keep the females of the March Moth also from ascending the trees. The insect is seldom seriously injurious. According to Theobald its usual food-tree is hawthorn or blackthorn, but it may be found on a variety of forest trees, and sometimes on plum and pear as well as apple.

The Green Pug Moth.

Chloroclystis rectangulata (Linn.).

In 1906 this insect was noticed on apple-blossoms from Co. Fermanagh (3, p. 331). In May of last year, blossoms with its caterpillars feeding were received from Co. Antrim.

The Pear "Slug Worm."

Eriocampoides limacina. (De Geer).

Pear-leaves badly injured by these grubs—caterpillars of a sawfly—were sent early in September from Co. Kildare by Mr. W. Tyndall, horticultural instructor. This insect seems to be seldom noticed in Ireland, though it is a well-known pest to fruit-trees in Great Britain; attacking usually pear or cherry. (Theobald, 12, pp. 334–7.)

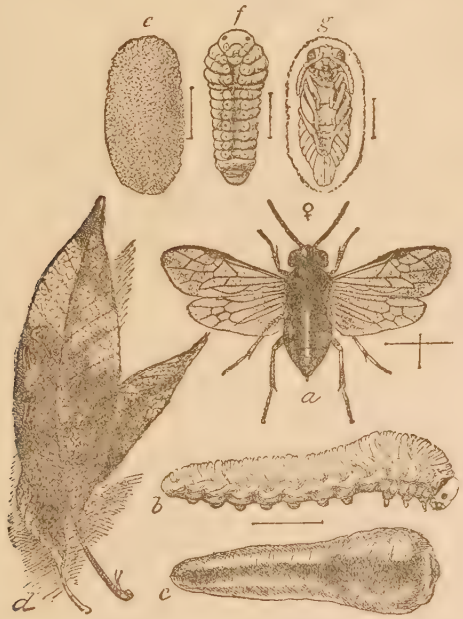

Fig. 5.—Pear Sawfly (*Eriocampoides limacina*): (*a*) female; (*b*) caterpillar in final stage; (*c*) caterpillar with its slimy coat ("slugworm"); (*e*) cocoon; (*f*) resting larva; (*g*) pupa. Magnified 4 times. (*d*) leaves with larvæ, reduced. From Marlatt, Entom. Circ. 26, U. S. Dept. Agric.

The sawfly, about 6 mm. ($\frac{1}{4}$ inch) long, is mostly black, with dusky bands across the wings (fig. 5 *a*). It appears early in June; and the female lays her eggs in little slits cut by the "saws" of the ovipositor below the leaves. The caterpillars are pale-yellow in colour, but, owing to a slimy secretion that oozes

from the skin, they appear black or dark-green (fig. 5, *c*), and feed mostly on the upper surface of the leaf, eating it into patches (fig. 5 *d*). In its last stage the caterpillar is yellowish, and its cuticle is dry and wrinkled (fig. 5 *b*). By the early part of July the caterpillars are fully grown; and they pupate in the soil an inch or two below the surface. In August the flies from these emerge; and their offspring are the caterpillars which, feeding in September and October, do most damage. These caterpillars bury themselves, and spin cocoons (fig. 5 *e*) in which they pass the winter; but they do not pupate (fig. 5, *f*, *g*) until the ensuing spring.

The wintering larva is a vulnerable stage in the life-history of this insect; and the removal and deep burial of surface-soil under trees where the caterpillars have been feeding may be recommended where practicable. During the feeding-period of the caterpillars lead-arsenate wash may be relied upon to poison them; and their habit of living on the upper surface of the leaf exposes their food to the action of the spray.

The Pear-leaf Blister Mite.

Eriophyes pyri (Nalepa).

This mite has been lately described and figured in this series of papers (3, pp. 581–3, fig. 9). In June leaves of Pear showing its characteristic blisters were received from Co. Wicklow.

FOREST INSECTS.

The Felted Beech Coccus.

Cryptococcus fagi, Barensp.

The presence of the cotton-like masses of these insects on beech-trunks has been previously noticed (3, p. 207). In May specimens were received from Mr. H. Waring, of Waringstown, Co. Down, stating that all the old trees on his grounds had been attacked by this pest during recent years; and that after about seven years' endurance the trees died off. In September specimens of the same insect were received from Queen's Co.

The Larch Aphid.

Chermes laricis, Hartig.

Shoots of Larch covered with the white cotton-like secretions of these aphids were received from Co. Down in August, and from Co. Antrim in October. The life-histories of various species of Chermes have been briefly described in a previous paper (3, pp. 584–6). The Chermes commonly found on Larch is known by most entomologists as *C. laricis* (e.g. Gillanders, 5, pp. 325–9). From Burdon's notes on Chermes (2, p. 137) it seems that he regards the insects as migrants from the spruce-feeding race known as *C. viridis*, Ratz.

The Pine Weevil.

Hylobius abietis (Linn.).

Reference has been made in several previous papers to this destructive and well-known beetle. Early in June, 1909, specimens were received from Lismore, Co. Waterford, where they were ravaging young plantations of larch, spruce, and Scots pine.

Small Ermine Moth.

Hyponomeuta cognatellus, Hübn.

This is the species of Hyponomeuta that feeds on spindle (Euonymus). It is somewhat larger than the hawthorn and apple-feeding species, *H. padellus* and *H. malinellus*, previously referred to (3, pp. 436–7). Towards the end of June shoots of spindle, with the web and caterpillars of *H. cognatellus*—which has similar life-history and habits to those of the other species—were received from Clonakilty, Co. Cork (sent by Mr. T. Christy), and from Enniskerry, Co. Wicklow (sent by Mr. R. M. Barrington). Some of the affected trees had been completely stripped of their foliage.

The Pine Sawfly.

Lophyrus pini (Linn.).

For several years past complaints of the damage done by the caterpillars of this sawfly to young conifers have been recorded

(3, pp. 447-8, 607). Early in September last, specimens were sent by Mr. J. A. Faris from Cavan, where they had devoured the shoots of young Scots pine.

The Fir-seed Chalcid.

Megastigmus strobilobius, Ratz.

(Plate II., B.)

I was greatly interested to receive in June from Mr. A. C. Forbes, Forester to the Department of Agriculture and Technical Instruction, two female chalcids which he had reared from seeds of silver fir in Co. Wicklow. Mr. Forbes believed the insects to belong to the above species which he had previously recognized in the south of England (see Gillanders, 5, p. 199); it has been reared in Denmark from seeds of *Abies pectinata* according to MacDougall (6) and Crosby (4). These two authors give much valuable information about species of Megastigmus and other Chalcididae, whose larvæ appear to devour the interior of seeds instead of living—as do almost all chalcid-larvæ—as parasites in the bodies of the other insects. The accompanying photograph (Plate II., B) shows the elbowed feelers, the excessively simple wing-neuration, and the long ovipositor which characterize the family. Megastigmus, instead of using the last-named weapon to pierce the body of some insect larva, bores with it into a developing seed and lays her egg, that her larva may find there shelter and food. MacDougall describes at length observations on the life-history of *M. spermotrophus*, Wachtl, a North American species whose larva lives in the seeds of the Douglas Pine; having been introduced into Scotland with its host tree, it threatens to become a serious pest. Those who are interested in Irish forestry may think it worth while to look out for similar introductions here.

GARDEN PESTS.

Spotted Millipedes.

Blaniulus sp.

Numbers of these millipedes were received at the end of April from a Co. Dublin garden, where they were reported as very destructive to the roots of various garden plants, potatoes and

strawberries. Associated with the millipedes were springtails of the species *Achorutes armatus*, which has been previously mentioned in these papers (3, pp. 251–3) as injurious to the roots of garden plants. In June further specimens of Blaniulus were received; which, in company with the Root Mite, *Rhizoglyphus echinopus* (see 3, pp. 258–60), were devouring bulbs of *Lilium candidum*.

Beeswax Mites.

Tyroglyphus siro (Linn.).

At the end of August I received from Mr. James Bracken, of Bandon, Co. Cork, some dust from a bee-hive empty of bees but containing comb. Mr. Bracken had noticed that the dust harboured mites, and these on examination proved to belong to *Tyroglyphus siro* (Linn.), the common cheesemite, which, with its ally *T. longior*, Gerv. (see 3, pp. 207–8) feeds on all kinds of substances—hay, meal, &c.—and in favourable conditions multiplies at an enormous rate. Beeswax is, I believe, an unusual food for these mites, though it need cause no surprise that they found it attractive.

The Harvest Bug.

Trombidium sp. (larva).

Almost every summer complaints are received of the irritation and discomfort caused by the minute creatures known as "harvest bugs" or "orange tawnies," which, lurking in thick vegetation, attach themselves to the skin of human beings—especially children and persons with delicate skin—burrow into the sweat-glands, suck blood, and set up an intolerable itching. These creatures are often especially abundant in old gardens, which may, under such circumstances, cease to be places of pleasure.

The "harvest bug" or "tawny" is the young larva of a red earth-mite (Trombidium)—a mite of fair size, with bright scarlet body covered with dense hairs or bristles, and, like other members of the class Arachnida, four pairs of legs. The family of the Trombidiidae contains the plant-sucking mites usually called "Red Spiders." These latter are members of the genera Tetranychus and Bryobia. The species of Trombidium are predaceous, provided with pincer-like mandibles and palps. They

may be found in the autumn feeding on small insects such as aphids; and in winter they shelter in the soil or beneath stones. In the succeeding spring they come out of their hiding-places; and the female lays her brown, spherical eggs—perhaps as many as 400 in one place. From these eggs are hatched in summer the larvae (fig. 6) or "tawnies," tiny, ovoid creatures, which, like young mites generally, have only three pairs of legs instead of the four that characterize their parents. The normal life-history is for the larval Trombidium to fasten on to the body of some insect or arachnid—muscid flies and harvestmen (Phalangidae) are often seen to harbour them—and from this host to suck nourishment until it becomes elongate and swollen. Then it drops off, seeks shelter, becomes first a four-legged nymph, and then an adult like its parents.

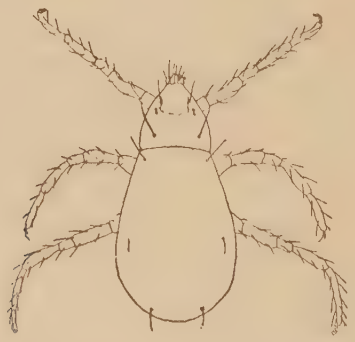

Fig. 6.—"Harvest Bug" or "Leptus," larva of a Trombidium. Highly magnified. From Chittenden (after Banks), Entom. Circ. 77, U. S. Dept. Agric.

Unfortunately a number of the little larvæ have the perverted instinct of fastening on human beings instead of flies or phalangids. They obtain a meal of blood; but, according to Banks (1), when they burrow into the human skin, they perish and never complete their transformations. It is said that they occur below the leaves of plants in shrubberies, &c., and drop thence when disturbed; they also swarm in long grass and herbage, for the feet and ankles are constantly attacked by them.

Of the various applications to the skin in order to allay irritation, ammonia and 10 per cent. carbolic acid seem the most

effectual. The clearance of rank growth in gardens is a preventive measure; and it might be found advantageous to spray the haunts of the larvæ with the paraffin and liver of sulphur emulsion that is commonly recommended against "red spider."

The Root-knot Eelworm.

Heterodera radicicola, Greef.

Through the kindness of Dr. G. H. Pethybridge I have received from Belfast tomato roots covered with the galls caused by this worm, which had hitherto been apparently unknown in Ireland. It was recorded by Miss Ormerod as injurious to tomato in England so long ago as 1892 (7), and mentioned by her in subsequent years. The genus Heterodera resembles Tylenchus (3, pp. 235–8) in possessing a stylet in the mouth, by means of which it pierces plant-tissues, but differs in its somewhat complicated life-history and the curious distinction in form between the sexes.

Fig. 7.—Root-knot Eelworm (*Heterodera radicicola*): (*a*) young, (*b*) older larva; (*c*) resting stage of male in larval cuticle. Magnified 80 times. From Sorauer "Pflanzenkrankheiten" (after Stone and Smith).

The young eelworm (fig. 7 *a*) is of the usual elongate, narrow form. As growth proceeds it swells, the head end being narrow and somewhat blunt, and the tail sharply pointed (fig. 7 *b*). In the case of the male the body of the worm separates from the cuticle of this swollen stage, and elongating within it becomes once more narrow and slender. After resting for a while coiled up in the old cuticle (fig. 7 *c*), it emerges as an adult male (fig. 8)

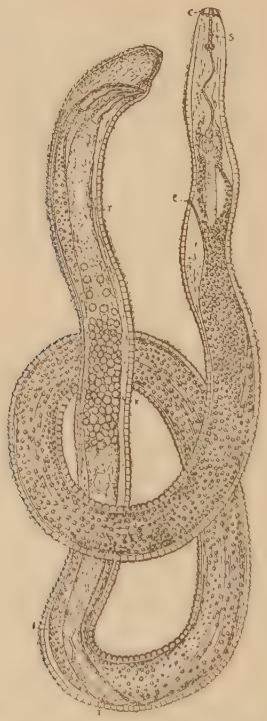

Fig. 8.—Root-knot Eelworm (*Heterodera radicicola*): adult male. Magnified 300 times. C, mouth; S, mouth-dart; E, excretory pore; I, Intestine; T. testis. From Sorauer.

with the tail-end distinctly blunt as compared with a Tylenchus, but otherwise like a typical eelworm in shape and about 1·5 mm. ($\frac{3}{50}$ inch) in length. The female, on the other hand, becomes greatly swollen except at the head end, about 1 mm. long and ·5 mm.

broad. The vaginal opening is at the hinder end of the body close to the anus (fig. 9 *A*). After pairing the eggs begin to develop, and the intestine and other internal organs are displaced and destroyed (fig. 9 *B*). The normal life-cycle is said to occupy a month.

A. B.

Fig. 9.—Root-knot Eelworm (*Heterodera radicicola*): Female; A, at time of pairing; B, with developing eggs; H, mouth-dart; K, bulb of gullet; G, vulva; E, anus. Magnified 80 times. From Sorauer (after Stone and Smith).

The female is found imbedded in the diseased swellings or galls which form on the roots through the presence of these worms. The eggs develop and are hatched within the cuticle of the dead female, whence the little larvae quickly come out. They may remain in the old gall, or wander out into the soil and bore their way into other roots; thus the infection is spread, and these worms in some countries attack a considerable variety of plants, such as vine, potato, cereals, leguminosæ, &c. In Great Britain, however, the species is known chiefly as an enemy to tomatoes and cucumbers in greenhouses. Sorauer (10, p. 39), who gives an excellent account of the life-history, lays stress on the importance of sterilizing the soil by means of steam under pressure. The use of "trap plants" to which the worms will go from the tomato-

roots is also recommended by Sorauer and by Ormerod, and lettuce appears to be the most satisfactory "trap." Such plants, however, need to be very carefully watched, and removed and burned before the young worms leave the galls; otherwise they will probably do more harm than good.

PARASITES OF ANIMALS.

The Ox-Louse.

Hæmatopinus eurysternus, Nitzsch.

In December a large number of specimens of these lice in all stages, together with eggs, were received from Clonakilty, Co. Cork. This evidence of active reproduction at such a season shows that the insects can be but little affected by climatic conditions. The adult insects vary from 5 to 8 mm. ($\frac{1}{5}$–$\frac{1}{3}$ inch) in length, the females (fig. 10 *a*) being slightly larger than the males. They have the usual louse-form, the head being less acute in front than in many species of the genus, and the body relatively broad. They cling to the hairs of the host by the strong single claw on each foot, holding against a spine on the penultimate segment, and suck blood by means of a flexible rostrum attached to the skin with stout recurved hooks (fig. 10 *b*) at its base, through which the flexible portion can be protruded.

The louse has a greyish, distensible cuticle over most of its body; the firmer regions and the legs being yellowish-brown, and the spiracles prominent at the sides of the segments. Below the hind part of the abdomen of the male is a broad, median dark-brown sclerite (fig. 10 *c*) in connexion with the genital opening. This sclerite is not present on the female's abdomen, which carries, however, beneath its penultimate segment, a pair of small bristle-bearing tubercles (fig. 10 *d*). The abdomen of the male is relatively narrower than that of the female.

The female louse lays her eggs singly on the hairs of the host, fixing each egg by a sticky secretion which hardens. The egg is narrow at one end and broad at the other, which has a cap-like lid (fig. 10 *e*). When the young louse is hatched, it lifts, or

bursts through, this lid. The young louse closely resembles its parent, except that the characteristic sexual abdominal structures are not apparent until after the last moult.

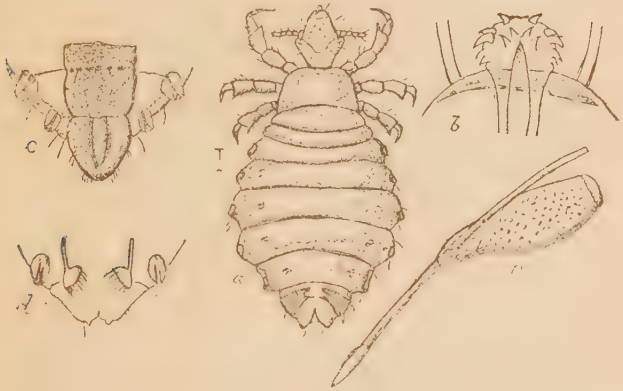

Fig 10.—Ox-louse (*Hæmatopinus eurysternus*): (*a*) female × 15; (*b*) rostrum with hooks, highly magnified; (*c*) end of male's abdomen; (*d*) of female's × 30; (*e*) egg × 15. From Osborn, Entom. Bull. 5 (n.s.), U. S. Dept. Agric.

The various washes recommended by veterinary surgeons—notably a concoction of delphinium—may, according to Osborn (8), be depended upon to clear cattle of these parasites if used thoroughly. It is doubtful if any application can destroy the eggs, so that it is advisable to wash twice at an interval of a week or ten days; the second application will kill the young lice hatched from eggs unaffected by the first.

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EXPLANATION OF PLATE II.

A. March Moth (*Anisopteryx aescularia*, Schiff.) × 1½.
[Photograph by T. Price.]

B. Fir-seed Chalcid (*Megastigmus strobilobius*) × 6.
[Photograph by T. Price.]

A

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ECONOMIC PROCEEDINGS.

VOLUME II.

No.

I.—Bacterial Rot in Turnips and other Brassicas in Ireland. By T. JOHNSON, D.SC., F.L.S., and J. ADAMS, M.A. (Plate I.) (February, 1910.) 6*d*.

II.—Injurious Insects and other Animals observed in Ireland during the year 1909. By GEORGE H. CARPENTER, B.SC. (LOND.), M.R.I.A. (Plate II.) (July, 1910.) 1*s*.